# SOCIO-ECONOMIC RESEARCH IN AGROFORESTRY: A

# REVIEW OF NINETY ARTICLES

**HIMSHIKHA**

*Research scholar, Forest Research Institute University, India*

**ABSTRACT**

A number of research articles reports were reviewed and analyzed. An initial screening was done and 90 abstracts were finally selected. Consideration was given to socioeconomic factors and agroforestry. Available literature was further grouped and categorized to notice improvements, set progress in chronological order and to understand their findings. The analysis demonstrates that factors studied in agroforestry practices have been varied in their amount, nature and types. Although most of the researchers tried to include a number of socioeconomic factors in their study, some of the results were highlighted with less number of factors elaborating influence on agroforestry adoption and vice versa. The review concludes that social factors have given importance mostly in 2011-2010 as 50% of total studies were reported under this category. Social factors are recorded bit less (22.22%) or almost equal to researches that studied other factors also. However, during 2010-2016 researches pertaining to economic factors' studies were reported in reduced numbers (5.56%) as compare to earlier studies done. Some factors lack latest studies and research is required to study their influence over agroforestry. Also, there are some important and influencing factors which need to be studied more so that their role could be understood well.

**KEYWORDS:** Adoption, Agroforestry, Factors, Socio-Economic, Technology

## INTRODUCTION

Socio-economic status of a farmer consists of many variables which can be categorized in to; social dimensions and economical etc. In agroforestry context, besides this there are some other dimensions which are directly or indirectly related to a farmer's socio-economic status and make effects vice versa. Socio-economical factors play direct role in certain management practices such as agriculture and agroforestry. Such socio-economic parameters and livelihood conditions of people also affect composition of species planted in their field. As we know that farmers in the same environment may have different objectives and livelihood strategies, and so respond differently to same agroforestry practice. In order to understand how farmers would respond to agroforestry practices, it is essential to know farmers perception of agroforestry. Socio-economic study of farmers and their relationship to the agroforestry is highly important as this would help to ascertain the opportunities for the development of agroforestry system (Irshad et al. 2011). A clear understanding of the influential factors in farmer's decision making related to the adoption and maintenance of agroforestry is important. Generally it should be stated that the socio-economic conditions are usually hard to identify and assess, as they are related to the human beings and their characteristics, which usually differ widely within the same community and from one community to another (Rai et al. 2006). This study is an attempt to highlight and review earlier research done in current progress and development of socio-economic research in agroforestry.

Original Article

## MATERIAL AND METHODS

In order to assess the status and development of socioeconomic research in agroforestry particular to factors, many papers were screened, reviewed and then analyzed in detail to access factors influencing adoption of agroforestry.

Screening**:** An initial screening of available research articles that had a substantial focus on socio-economic factors related to agroforestry was done. For this first, abstracts of all available and collected articles published between 1981 and 2016 were properly examined, and those having relevant account on any kind of socio-economic information were selected for review purpose. Such articles were listed and studied in detail so that maximum amount of knowledge or information on socio-economic research in agroforestry could be gathered. This process resulted in a total number of 90 research articles which were then re evaluated to find out maximum quality content on socioeconomic studies in agroforestry and its adoption.

Assessment of factors: To facilitate analysis, reports were divided in to three groups based on the nature of contained factors elaborating the findings of these studies. These groups were further divided into 26 major factors categories according to their types. A factor wise chronological order (1981-1990, 1991-2000, and 2001-2016) of selected articles was also set to complete analysis in periodic way.

## RESULTS AND DISCUSSIONS

Till today, several studies have been done on socio-economics of agroforestry. Research over the past two decades (1970-1990) has focused on exploring the biophysical and ecological aspects of agroforestry with a limited emphasis on social and economic aspects of agroforestry, especially economics. However, both the scope and quality of socio-economic research is slowly improving as noted by Mercer and Miller, (1998) and Abdrabo and Hassaan, (2003). Here below, some socioeconomic factors are reviewed to understand their effect on adoption of agroforestry practices.

**Table 1: Number of Published Articles on Socioeconomic Research in Agroforestry from 1980 to 2016**

| Socio-Economic Group | 1981-1990 Freq. % | 1991-2000 Freq. % | 2001-2010 Freq. % | 2011-2016 Freq. % | Total Freq. % |
|---|---|---|---|---|---|
| Social research group | 2       2.22 | 4       4.44 | 45      50.00 | 20 22.22 | 71 78.89 |
| Economic research group | 1       1.11 | 6       6.67 | 20      22.22 | 5 5.56 | 32 35.56 |
| other | 2       2.22 | 15      16.67 | 27      30.00 | 20 22.22 | 64 71.11 |

From this table it is understood that maximum number of available studies were done during year 2001-2010. Besides social and economic factors, there are some other factors which generate notable influence on adoption of agroforestry, hence were studied maximum as compare to social and economic factors' group all time. However this numbers does not represent other factor group solely, but is an outcome of combined group studies. In total reviewed 90 articles, 71 articles (78.89%) were included in social research group, 32 articles were contained economic research hence included in economic research group, 64 articles were included in other factor group as they contained some other factors that had as association with agroforestry. Here one thing needs to be mentioned that there were many research articles which contained social, economical and/or other factors, hence included in all categories.

**Social Factors**

**Table 2: Number of Published Articles on Socioeconomic Research Containing
Social Factors Affect in Agroforestry from 1980 To 2016**

| Sr. No. | Type of Social Factors | 1981-1990 | 1991-2000 | 2001-2010 | 2011-2016 | Total |
|---|---|---|---|---|---|---|
| 1. | Age and experience | - | - | 6 | 2 | 8 |
| 2. | Decision making process | 1 | - | 2 | 1 | 4 |
| 3. | Education & understanding to agroforestry | - | - | 3 | 2 | 5 |
| 4. | Extension services and training programme | - | - | 4 | 1 | 5 |
| 5. | Family size | - | - | 2 | - | 2 |
| 6. | Gender | - | - | 5 | 1 | 6 |
| 7. | Household condition and security | - | - | 3 | 2 | 5 |
| 8. | labor | 1 | 3 | 7 | 2 | 13 |
| 9. | Market/marketing facilities | - | - | 2 | 3 | 5 |
| 10. | Technical assistance & institutional support | - | 1 | 4 | 1 | 6 |
| 11. | Training and extension facilities | - | - | 2 | 1 | 3 |
| 12. | Land/ farm size | - | - | 4 | 2 | 6 |
| 13. | Land use/ land security & land/ tree tenure | - | - | 1 | 2 | 3 |
| | **Total** | **2** | **4** | **45** | **20** | **-** |

Above table shows labor availability as one of the main social factors which were studied during 1981-2016. Maximum number of studies including social factors was reported during 2001-2010.

- **Age and Experience**

The most extensive review of socio-economic factors influencing adoption found both positive and negative relationships between age and adoption (Rogers, 2003). In some cases older people are more willing to adopt because they have had more years of farming experience. However farmers with long experience might also reject the new practices as they are satisfied with the traditional system (Tenge et al., 2004). In his study, Keil et al. (2005) reported a 75.5 percent adoption rate of improved fallows among experimenting farmers. It goes in favor to the argument that older farmers happen to be resistant to new technologies (Amsalu and De Graaff, 2007) and found to be significant only in deciding whether to continue with the technology or not as they were not willing to continue as compare to younger ones (Kabwe, 2010 and Ajayi et al. 2006). Some scholars linked the length of experience with the age of farmers, as an older age was linked with length of farming experience and could positively influence the adoption of new agroforestry practices. The likelihood of adoption is also related to age (Mutambara et al., 2012). The experience may be related to age of the farmer. It is expected that farmers with long years of experience have better managerial ability and tend to be more practical (Surendra and Mahesha, 2015).

- **Decision Making Process**

Earlier researches have shown that male farmers have authority in making decisions that relate to farming activities such as labour allocation and production and not more than five percent of women participation in farming decisions (Vail, 1981). Thangata et al. (2004) found decision making in many smallholder farming systems, of farmers' an integral part of the overall strategy for ensuring subsistence and household cash income and about the choice and management of agroforestry practices. These kinds of trend are only broken in very special or rare circumstances when a divorced, widowed or single woman takes the role of the decision-taker as an individual. Therefore, there is limited power of women in the decision making process (Kabwe, 2010). Also, the different roles men and women play in a community

can hinder the adoption of agroforestry if they are not considered in advance (Glover et al. 2013).

- **Education and Understanding**

A low education level can be a barrier for agricultural development, since education normally has a significant influence on a household's income, land management and labour use (Nkonya et al. 2004). In the case of adoption of tree planting in the farms in India, younger farmers with better education developed a positive attitude towards tree growing (Sood and Mitchell, 2004). Also, the positive effects of education on adoption of desirable land management practices have been reported (Matata et al. 2008). A study done by Irshad et al. (2011) found that education level of the head of the family is an effective factor to encourage on-farm growing of trees. The influence of education (literacy) on agroforestry system was highly correlated. The educated farmers have allocated more size of the farms for trees as compared to illiterate farmers. In Mutambara et al. (2012) point of view, years of education also influence adoption of agroforestry.

- **Extensional Services and Training Programmes**

According to Nguyen (2001) training activities are more important to evaluate ongoing activities of application of training, to help reinforce information and complete the training experience especially for the less educated farmers. In Mudhara and Hildebrand's (2004) point of view, an efficient extension organization will hasten the adoption process. The limited acceptance of agroforestry activities is also said to be due to lack of attention that researchers and extensionists give to the farmers (Zubair & Garforth, 2006). If farmers have to achieve high and better results from agroforestry, they need to be exposed to both the knowledge and skills of implementing it as reported by Kabwe (2010). Adding to this, Glover et al. (2013) mentioned that awareness must be created by extension services about research on issues such as tree enterprise development and tree-product marketing enhancement.

- **Family Size**

A study of Sood (2006) in the Western Himalayas indicated that agroforestry adoption increased when farmers had a smaller family. This is probably because planting and managing trees are less labour intensive than agriculture. Families are viewed as the real decision making units, and not only considered as opinion sources but as actors in making egalitarian or conjoint decisions through a negotiation process (Kabwe, 2010). Bigger family size has supported promotion of agroforestry.

- **Gender**

While studying female participation, Opio (2001) established that lack of security of tenure was hampering female farmers from participation. Thangata and Alavalapati (2003) observed that both male and female headed households can adopt the improved fallow technology in agroforestry. This lends support to the later finding of a study done by Thangata et al. (2004) that adoption of agroforestry is gender neutral. Based on findings of a study done by Mudhara and Hildebrand (2004), fifty-three percent of the households' differentiated labor by gender and when differentiating labor by gender, male labor carried out specified tasks, different from those carried out by female labor. This limitation made households less able to adopt agroforestry. In another study, Ahlawat and Hasumati (2009) described gender factor and examined why women are not involved in agroforestry, why they are important to agroforestry and why agroforestry needs women's involvement. Kiptot and Franzel (2011) also presented the findings of review undertaken on gender and the adoption of agroforestry stating that although women are as actively involved in agroforestry as their male counterparts, their level of participation is low as reflected in the number of shrubs/trees they plant relative to men. Hence, the different roles men

and women play in a community can hinder the adoption of agroforestry if they are not considered in advance.

- **Household Condition and Security**

In a study of typology and characteristics of farmers, Ajayi et al. (2006), mentioned that poor farmers perpetually remain hungry. Poverty alleviation is also concerned with how agroforestry can provide income, food, fuel and shelter to farmers and their families. Another factor is household condition. It is essential to observe the adoption of traditional agroforestry in relation to the economic and farming conditions of households (Sood, 2006). Household security, as a factor in the adoption of agroforestry, relates to the need that any introduced system must at least not detract from farmer/household security, and at best increase it (IAEA, 2008). For example, higher availability of fuelwood from State forests could lead to lower levels of agroforestry adoption (Singh and Pandey, 2011) Security can be enhanced by an agroforestry through provision of basic needs such as food, construction wood, and fuelwood, through cash income or through decreasing labour or input costs (Glover et al., 2013).

- **Labor**

It is envisaged that labour shortages usually have a negative effect on the farmers" adoption (Feder et al. 1985) and an increase in labour requirements is one reason that farmers do not adopt new systems (Nowak, 1992). Availability of labor reduces the labour constraints (Nkonya et al. 1997). Hence, it tends to increase the adoption of new technologies (Abadi Ghadim and Pannell, 1999). In adoption decisions, farmers are concerned if new practices will increase labour requirements. Further, the availability of family labour is often mentioned as one of the variables influencing the adoption of technologies (Rajasekharan and Veeraputhran, 2002). Labour is also considered a limiting factor, to a farmer's decision to practice agroforestry (Ajayi et al. 2003). While differentiating labour availability and requirement in their study (Mercer and Snook, 2004), labor attributes appeared to be counter intuitive with the low and medium labour levels producing negative utility values while the highest additional labour level was strongly positive and significant. When labor is limiting, households are less able to adopt as less labor becomes available for conducting work (Mudhara and Hilderbrand, 2004). In another form, factor influencing farmers' decisions to get involved with agroforestry include availability of labour supply (Ajayi et al. 2006). Although, in a case study done by Sood (2006) results were contradictory to above said notions as according to them constraints on family labour availability for agricultural operations resulted in increasing the extent of agroforestry adoption. This was probably because farmers thought that agroforestry such as planting trees was less labour intensive than agriculture and families with a shortage of family labour for agricultural work chose planting tree options for their land use to avoid high labour demands. Therefore, there was increased agroforestry adoption by households with less labour available than by households with more family labour available for farming. Labour is also considered as a limiting factor, to the expansion of the practices (Kabwe, 2010) because availability of labour and its cost or reduced possibilities for commercial production, without acknowledging the existence of a broad spectrum of different agroforestry options under various conditions will affect a farmer's decision to adopt a particular agroforestry system (Glover et al. 2013). Hence, an increase in farm labour availability increases probability of adoption of agroforestry practices (Mombo et al. 2016).

- **Market/Marketing Facilities**

Keil et al. (2005) concluded that improved fallows could only be suitable in situations where there was inadequate access to markets for fertilizer. In a study by Sharma et al. (2009) lack of proper price was reported as major constraints in

adoption of agroforestry by farmers. In another study done by Irshad et al. (2011), lack of market was also reported as constraints in adoption. Smith et al. (2012) ascribed a need to identify clear market and policy reasons for providing support, by collating, managing and, through research, providing evidence on the benefits (and limitations) of and mentioned that when the objective is a marketable product, a critical aspect is the accessibility and stability of a market. Agreeing with this, Glover et al. (2013) stated that because the marketing aspects are also important to the farmer, farmer also needs to have access to information about the market.

- **Technical Assistance and Institutional Support**

    Mercer and Miller (1998) endorsed that the lack of strong agroforestry institutions and the short-sighted focus and priorities of governments and donor organizations result in limited funding opportunities for agroforestry socioeconomic research. The study by Ajayi and Kwesiga (2003) looked at how local institutions impact on adoption and concluded that the local institutional arrangements and the pattern of distribution of benefits are important in enhancing or inhibiting widespread uptake of the technology within the community. This may suggest that farmers view the systems as complicated, difficult, and/or risky to adopt without adequate assistance (Mercer and Snook, 2004). While studying the institutional setup and support Kiptot et al. (2007) illustrated some factors such as government policy, extension services, local/national governments and non Governmental Organizations (NGOs) and the political situation influencing adoption. Rehman et al. (2008) mentioned that an action for agroforestry should focus first of all to get supportive institutions. Okia et al. (2009) expressed an urgent need to test the robustness of technology in agroforestry. To this, Kiswan and Kumar (2011) also stressed upon the need of institutional support, facility of minimum support prices credit and insurance facility and flow of research grants.

- **Training and Extension Facilities**

    Training as informal education becomes very important in the area where the educational level of the farmers is low (Nguyen, 2001). Technically there are several methods of training that work best for farmers, such as training of farmer trainers and farmer visits (Ajayi et al. 2006). According to Glover et al. (2013) extension method and knowledge through it play important role in adoption of agroforestry system.

- **Land/Farm Size**

    In their review on the adoption in developing countries, Feder and Umali (1993) mentioned that land size factor is important in the adoption of new technology. In their assessment studies on constraints Mudhara and Hildebrand (2004) advised that households with larger farms should be able to adopt more compared to those with smaller farms. The major implication arising from the results of a study done by Thangata et al. (2004) was that effort should be directed to farmers with enough land to encourage adoption. Although Keil et al. (2005) found land to be a limiting factor to increasing the size. Hence, we should be aware of the different roles that agroforestry plays for distinct types of farm categories. More particularly, the role of farm size on the decision to adopt new technologies may differ for each case study, as when farm size is large and labour availability is low, then farmers may be more ready to adopt agroforestry practices such as woodlots. On the other hand, when farm sizes decrease, they may also become more interested in higher yielding but more labour intensive systems such as alley cropping or highly productive home gardens (Glover et al. 2013). Showing the responses for earlier statement of Mudhara and Hildebrand (2004), Mombo et al. (2016) found out that farm size was positive and significant determinant and concluded that large landholding owners are more likely to adopt agroforestry and

any increases in farm size, would increase probability of agroforestry adoption.

- **Land Use, Land Security and Land/Tree Tenure**

Adoption in agroforestry is most likely consistent with economic criteria for land use changes (Scherr, 1995). Although tree and land tenure are distinct factors, they affect each the other. Tenure in agroforestry concerns both land tenure and tree tenure. Because of the long term nature of agroforestry systems, security of land tenure (Abebaw, 2012) is important for adoption of agroforestry (Glover et al. 2013).

**Economic Factors**

**Table 3: Number of Published Articles on Socioeconomic Research Containing
Economic Factors Affecting Agroforestry from 1980 to 2016**

| S. No. | Type of Economic Factor | 1980-1990 | 1991-2000 | 2001-2010 | 2011-2016 | Total |
|--------|-------------------------|-----------|-----------|-----------|-----------|-------|
| 1. | Capital (land and finance) | 1 | 1 | 3 | 1 | 6 |
| 2. | Credits and incentives | - | 3 | 4 | 1 | 8 |
| 3. | Employment and income generation | - | - | 4 | 1 | 5 |
| 4. | Income and wealth status | - | 2 | 4 | 1 | 7 |
| 5. | Perceived benefits | - | - | 1 | - | 1 |
| 6. | profits | - | - | 4 | 1 | 5 |
| | **Total** | **1** | **6** | **20** | **5** | **-** |

Table 3 represents number of published articles on socioeconomic research containing economic factors influencing adoption of agroforestry from 1980 to 2016. It shows interest of researchers was mostly in credits and incentives influence studies, followed by profits, capital, income and wealth status etc.

- **Capital (Land and Finance)**

Considering agroforestry as technology, Feder et al. (1985) wrote that differences in availability and access to capital are often mentioned as a major obstacle in technology adoption. Another study done by Sail and Muhammad (1994) revealed that the reason for farmers not adopting new technologies was mainly financial constraints. Phiri et al. (2004) considered an association between farmers' wealth status and the agroforestry practice and concluded that the improved fellow practice was being highly adopted among farmers that were classified as wealthier than among the very poor households. Supporting this perception, Keil et al. (2005) noted that adoption increased with wealth levels, starting with those described as fairly wealthy, and decreased with well-off farmers. Also, households that do not have ownership to lands may not be able to benefit from the agroforestry interventions for livelihood's improvement (Pandey, 2005). According to Irshad et al. (2011), agroforestry practices are strongly dependent on access to land within the community and lack of capital not only limits farmers' capability to adopt but also makes the farmers modify or substitute other practices.

- **Credits and Incentives**

Agroforestry interventions, as new techniques, often used cash incentives and subsidies to promote adoption (Arnold, 1991). Several studies have reported that external incentives are most successful when they are small (Current and

Scherr, 1995). Incentives and credits have both positive and negative aspects in agroforestry. As Mc Donald and Brown, (2000) noted that incentives have been used to speed the adoption which can be useful for facilitating initiation of positive change and adaptation, and also in order to reduce the risk. In terms of adoption, Rogers (2003) defined incentive as payments of cash that are given to person or system in order to encourage behavioral change including the adoption of a new idea, although incentives increase the quantity of adopters, a possibility that the quality of adoption becomes low. Franzel (2004) did not considered credit as a constraint to adoption. Pandey (2005) indentified incentives as challenge that promote tree-growing by rural people. In another study, Shiferaw et al. (2009) also recognized credit to have a significant effect in stimulating farmer adoption. However, low levels of incentives and self-financing may lead to a slower, pace of adoption but one that may ultimately be sustainable (Glover et al. 2013).

- **Employment and Income Generation**

Agricultural decisions made by individuals (or farmers) are often influenced by their economic opportunities (Lambin et al. 2001). A study by Dhyani and Sharda (2005) highlighted the potential of agroforestry for rural development and employment generation to a sum of 5.763 million human day year-1 from Indian Himalaya alone. In his review, Pandey (2005) examined the multifunctional agroforestry systems in India as a potential option for livelihoods as well as yield of goods and services to the society. This synthesis of available literature also helps in identification of remaining uncertainties in the future direction for research. In their study Dwivedi et al. (2004), reported assured incomes as one of the major motivating factor for adoption of commercial agroforestry. Glover et al. (2013) also noted importance of increased production in promotion of agroforestry and raising farmers' income.

- **Income and Wealth Status**

After analyzing the factors influencing adoption of agroforestry practices, Alavalapati et al. (1995) supported the criticism that higher income farmers are the main beneficiaries of agroforestry. Sharma and Kumar (2000) reported significantly higher socioeconomic status for the farmer adopting poplar based agroforestry than those of non-adopters. Mercer and Pattanayak (2003) stated that variables of expected yield increases and more income from farming positively influenced the adoption of agroforestry. Keil et al. (2005) also concluded importance of the wealth status for market facilities and resource approach. An understanding of the factors affecting farm income allows policymakers to devise measures to support their livelihood and encourage sustainable land use (Safa, 2005). Considering income and wealth status, Kabwe (2010) reported that farmers that were classified as poor and very poor had lower rates of adoption. Similar to this, Irshad et al. (2011) found that higher monthly income of the farmers was found positively associated to the presence of trees on their farms.

- **Perceived Benefits**

In their study, Mercer and Snook (2004) noted that farmers preferred agroforestry systems that produced both timber and crops over strictly forestry systems that only produced timber, reflecting their preferences for sustainable production of both wood and food products.

- **Profit/Profitability**

Profitability is found to have a significant influence on the adoption of agroforestry by smallholder farmers (Rajasekharan and Veeraputhran, 2002). Mercer and Pattanayak (2003) stated that variables of expected yield increases and more income from farming positively influenced the adoption of agroforestry. Hence, new practices may not

encourage adoption unless there is increased productivity and profitability (Amsalu and De Graaff, 2007) as Baerenklau and Knapp (2007) mentioned that farmers will adopt a new technology if they think it is profitable. According to Mandal et al. (2011) farmers particularly small and medium categories, give prime importance to the continuous flow of income before adopting and practicing any new technology.

**Other Factors**

**Table 4: Number of Published Articles on Socioeconomic Research Containing other Relevant Factors Affecting Agroforestry from 1980 to 2016**

| S. No. | Other Factor | 1980-1990 | 1991-2000 | 2001-2010 | 2011-2016 | Total |
|---|---|---|---|---|---|---|
| 1. | Govt. policies & support | - | 4 | 7 | 5 | 16 |
| 2. | Information | 2 | 2 | 3 | - | 7 |
| 3. | Knowledge & awareness | - | 4 | 6 | 2 | 12 |
| 4. | Legal issues | - | - | 1 | - | 1 |
| 5. | Perceived risk & uncertainty | - | 2 | 2 | 1 | 5 |
| 6. | Perception and attitude | - | 3 | 7 | 2 | 12 |
| 7. | Self efficacy | - | - | 1 | - | 1 |
| | **Total** | **2** | **15** | **27** | **20** | **-** |

Table 4 illustrates the number of published articles on socioeconomic research containing other relevant factors influencing adoption of agroforestry from 1980 to 2016. It shows that among these factors, maximum number of factors was reported during 2001- 2010. Government policies and support is main factor which is reported to be influencing in most of researches (17). Other factors are perception and attitude (15), knowledge and awareness, land/farm size and perceived risks and uncertainties about adoption of agroforestry practices.

- **Government Policies and Support**

Obviously finding a solution to to encourage tree planting on farms, Arnold and Dewees (1998) argued that strategies which are developed need to be based on an understanding of farmers' tree management. According to Mercer and Miller (1998) agroforestry project implementation in many countries is hampered by the lack of appropriate policies to support such efforts. A wide variety of policies directly and indirectly influence the ability of agroforestry to deliver benefits to individual farmers and the larger society. Policies affecting labor, capital and goods markets, land and tree tenure policies, and energy policies influence agroforestry decisions of small, subsistent farmers especially in rural areas. Policy also plays an important role in influencing farmers'' decisions and subsequently the adoption of agricultural practices (Sechrest et al., 1998), affecting at farm, community and national or regional levels (Place and Dewees, 1999). Adding to it, Franzel (2004) suggested complementing the assessment of profitability of agroforestry with other factors such as policy constraints in assessing the feasibility, acceptability and adoption potential of agroforestry. Puri and Nair (2004) elaborated the need to involve local communities in the policymaking process, hence supported earlier arguments of Arnold and Dewees (1998). Since 2004, additional approaches have been used including use of existing local institutions and sensitization of policy makers about agroforestry benefits through production of policy briefs (Ajayi et al. 2006a). Government policies hold the key to adoption and promotion of agroforestry. Fones-Sundell and Teklehaimanot (2006) agreed with this and noted that clear policy by the government is a necessary pre-condition for agroforestry to be adopted and that policy can only be established if the government recognizes agroforestry as a good land use practice. Although widespread adoption of agroforestry technologies requires appropriate policies at local and national levels (Boeckmann and Lolster, 2010). Kabwe, (2010) raised the indicating statement of ICRAF (2007) that agroforestry has been overlooked in

terms of Policy, and that its association with both agricultural and forestry policies has often affected agroforestry negatively. According to them, agroforestry adoption cannot take place in a policy vacuum. Hence a study on the extent to which agricultural and forestry policies include and promote the adoption of agroforestry is necessary. Forest policies which impose restriction often acted as a disincentive to maintaining tree based mix cropping system (Gullerme et al. 2011). In their study, Kiswan and Kuamar (2011) stressed upon the need of reviewing the policy, rules and regulations related to indigenous tree species. Msuya and Kideshegheso (2012) reported numerous policy based constraints hindering success of agroforestry. A number of important factors are directly linked to policy. In some cases, these policy 'failures' can be over-riding of others and their alleviation critical to wider adoption, a first justification for why adoption of agroforestry is a policy issue (Place et al. 2012). Glover et al. (2013) mentioned in appropriate national policy and strategy a further constraint. According to him the prices on the market have to be favorable and attractive to the farmer. This does not only mean that prices have to be high enough to secure a profit margin, but also that prices have to be stable.

- **Information**

Information gained by examining the actions and performance of neighbors, friends, and relatives who have conducted experiments with the new technologies is an important factor influencing other farmers (Feder et al. 1985). As a source of information and knowledge sharing Promoting farmer-to-farmer approaches might be advantageous in adoption process (Chambers et al. 1989). The lack of information regarding the economic or technical issues of the technology is often regarded as a barrier to adoption (Nowak, 1992). A case study in Pakistan found that farmers relied on their neighboring farmers when searching for information regarding new farming systems (Muhammad and Garforth, 1999). It is suggested that direct contact between extension workers and farmers, along with informal discussions between neighboring farmers are key elements in the adoption of new practices especially for farmers at the evaluation or trial stage of the new technology (Glendinning et al. 2001). This confirms to the view that informal social networks such as relatives, friends and groups are an important possibility for spreading new technologies (Kiptot et al. 2006). Kabwe, (2010) supported the view of Glendinning et al. (2001) that access to information is an important factor that influences adoption decisions in India. However the lack of information may be correlated to other factors such as the extension system, availability of communication facilities etc.

- **Knowledge and Awareness**

Perception of an innovation is influenced by the household's knowledge, knowledge source, and how this knowledge is transferred into the community (Andrew and Rikoon 1997). In their review, Mercer and Miller (1998) illustrated gap in socioeconomic knowledge as important factor influencing adoption behavior of farmers in agroforestry. In his study, Peterson (1999) established that lack of awareness about agroforestry was limiting the farmers' involvement. Relating awareness with agroforestry adoption, Sharma and Kumar (2000) reported significantly higher awareness for the farmer adopting poplar based agroforestry. It shows that agroforestry adopters are more aware than that of non adopters. In this indigenous knowledge includes the complex of practices and decisions made by local people and is based on experience passed from one generation to the next (Oudwater and Marti, 2003). This factor becomes more important because farmers know the reason why and how they should retain different tree species that are suitable and unsuitable for agroforestry practice. Mekoya et al. (2008) assessed knowledge as awareness and concluded that when these factors are not in congruence, farmers' practices show divergence from their awareness and attitudes. Chauhan et al. (2009) did a favour to study done by Oudwater and Marti (2003). Both studied described that poor motivation and low awareness among the

farmers may be the major causes for less adoption of poplar cultivation. Hence, the lack of knowledge about implementation of new practices is an important barrier to the adoption (Chowdhury and Ray, 2009). Reporting same cause as constraints, Samiee et al. (2009) reported it as an important barrier to the adoption. Kabwe (2010) mentioned agroforestry as knowledge intensive, requiring farmers to be assisted with understanding. Thus, knowledge and communication are viewed as playing key roles in the participation process. Therefore, farmers need to increase their knowledge of the new practices as knowledge plays a crucial role in the adoption. Basamba et al. (2012) also reported include lack of awareness as a socio-economic factors that affect farmers' participation in agro-forestry markets. Knowledge of market is critical, as it can help identify whether agroforestry interventions have the possibility of saturating them and therefore bringing prices down. As local knowledge and management originates from farmers' direct observations of nature processes and its influence on the crops, the explanation of the techniques and the process itself is not always known. For this reason, some researchers, as in the case study of "modern" sustainable agroforestry system developed in Brazil, apply local knowledge but at the same show some scientific hypothesis to be proved in the process. In other cases effective integration of local knowledge and perspective are increasingly necessary for agroforestry (Glover et al. 2013).

- **Legal Issues**

Many provisions of the forest-related legislations in India (e.g., the legal hurdles associated with harvesting and transporting of timber) act as serious disincentives to tree farming on private lands (Kumar and Peter, 2002).

- **Perceived Risk and Uncertainty**

Farmers reduce risk associated with new agroforestry practices through increased adoption and adaptation (Scherr, 1995). Mercer and Miller (1998) reported that perceived risk and uncertainty about agroforestry could explain the low adoption rates. Increased risk is often considered as an important obstacle to adoption (Amacher et al. 2004). Opposite to it, farmers sometimes adopt to reduce associated risks in agroforestry. However uncertainty in response to new technologies usually leads the farmers to seek more information (Dearing, 2009). Studies also revealed that less risk compared to agriculture was cited as major reason for taking up the tree plantation. It supports the idea of Glover et al. (2013) that, adoption of an agroforestry system brings risks that are less familiar to a farmer.

- **Perception and Attitude Towards Agroforestry**

In the context of household livelihood strategies, Arnold and Dewees (1998) pointed out that little is known about "farmers' perceptions of the value of trees" and about the constraints they face in developing tree resources. Negata and Parikh (1999) suggested that farmer's perceptions make a difference. Sharma and Kumar (2000) reported significantly higher attitude for the farmer adopting poplar based agroforestry than those of non-adopters. The farmers' positive perception is indicated as an important step in adoption process (Franzel et al. 2002) and farmers that are involved in on-farm experimentation of agroforestry technologies with the researchers are more likely to adopt than those who are not (Phiri et al. 2004). Citing earlier studies, Khan et al. (2008) mentioned that farmers' subjective perceptions play a key role in agricultural technology adoption. Finding also stated that attitudes significantly predicted farmers' decisions to adopt agroforestry. Models by Mc Ginty (2008) indicated that attitudes play an important role in farmers' intentions to adopt or maintain agroforestry. In addition to adequate knowledge and favorable attitudes, decisions to adopt a given practice may require socioeconomic environments (Mekoya, 2008). In their study, Chauhan et al. (2009) found that less favorable

attitudes among the farmers may be the major causes for less adoption. Thus the adoption levels still remain low. Adopters' perceptions can, in turn, be influenced by their experiences and social networks with other people. These might include other farmers. Sometimes, farmers do not adopt because the technology does not fit with existing practices (Kabwe, 2010). In another study, Irshad et al. (2011) addressed that farmers' perceptions has shown a strong step for the positive outcomes of tree planting and opinions of farmers towards agroforestry either encourage or discourage farm level tree plantation. Mombo et al. (2016) reported positive attitude of farmers towards agroforestry showing that they realized the contribution of agroforestry on their farm plot which was important in adoption of agroforestry practices suggested that farm and concluded farmers with higher attitude have positive relationship with adoption of agroforestry.

- **Self Efficacy**

Self efficacy has proven to be a key factor in people's behavior, especially their perseverance in facing challenges in any agroforestry practices. Additionally, when resources are present and socio-economic conditions exist to adopt, a farmer's self-efficacy about the specific tasks may become an important factor. Also, long-term success of agroforestry development programs may be highly influenced by farmers' self efficacy to manage the agroforestry systems (Mc Ginty, 2008). Hence, it may be another factor to be added in socio-economic factors to explain the agroforestry adoption.

## CONCLUSIONS

Not every farmer wishes to adopt agroforestry in his field. According to this study, the decision of agroforestry adoption may be influenced or linked to different factors at different levels. While studying agroforestry, supporters of socio economics also tried to incorporate all major factors belonging to a farmer or farmers' group. This analysis of 90 papers highlights major socio-economic factors and their influence on adoption of agroforestry. Review has shown that there was less number of available literature/ articles on socioeconomic research on agroforestry done during 1981-1990. However it does not mean that researchers did not contributed to socio-economic research during that time period. Similarly maximum articles to be reviewed were available from 1991-2010. It helps us finding out major socio-economic factors studied during these last two decades. From table 1, it is clear that maximum articles results had discussed social factors more than economical and other factors in their study. It depicts importance that scholars have given to social factors over economical and other factors. Socio-economic factors which were studied most during 1981-2016 were knowledge and awareness, perception and attitude, perceived risk and uncertainties, profits, credits and incentives, income and wealth status and labor. Farm size, agro-climatic zone, soil fertility, mobility and importance of tree for future generations and use of indigenous knowledge of farmers are also considered key factors which may influence tree growing (Sood and Mitchell, 2009). Although most of the researchers tried to include a number of socio-economic factors in their study, some of the results were highlighted with less number (even a single number) of such factors elaborating their influence on agroforestry adoption and vice versa. Also, there are some factors which seem equally important and rather more influencing, hence need to be studied more so that their role in agroforestry and its socioeconomics could be understood well. The review done convinced that the farmers are able to raise incomes from their tree-crop cultivation significantly. From review it is clear that age, perceived risk and uncertainties, income, house hold conditions, family size, land holding, arming experience are strongly related to farming success in any region. Social factors were given importance mostly in 2011-2010 as 50% of total studies were reported under this category. In current scenario, researches containing social factors are recorded bit less (22.22%) or almost equal to researches that studied other factors also. However, during 2010-2016 researches pertaining to economic factors' studies were reported in reduced numbers (5.56%)

as compare to earlier studies done earlier during 2001-2010. This study concludes that some factors especial the economic factors, lack latest studies and latest research findings are required to study their influence over agroforestry adoption.

## REFERENCES

1. Abadi Ghadim AK, Pannell DJ (1999) A conceptual framework of adoption of an agricultural innovation. *Agricultural and Resource Economics 21: 145-154*

2. Abdrabo MA, Hassaan MA (2003) From river catchment to the sea: comparative and integrated approach to the ecology of Mediterranean coastal zones for sustainable management ( MEDCORE). A manual for socioeconomic study. Centre for environment and development for the Arab region and Europe, (Cadare)

3. Abebaw D, Kassa H, Kassie GT,  Lemenih  M, Campbell B, Teka W (2012) Dry forest based livelihoods in resettlement areas of Northwestern Ethiopia. *Forest Policy and Economics 20: 72-77*

4. Ahlawat S, Hasumati DS (2009) Empowerment of rural women through their participation in agroforestry. *Shodh, Samiksha aur Mulyankan 5(2): 549-552*

5. Ajayi OC, Franzel S, Kuntashula E, Kwesiga F (2003) Adoption of improved fallow technology for soil fertility management in Zambia: Empirical studies and emerging issues. *Agroforestry Systems 59(3): 317-326*

6. Ajayi OC, Massi C, Katanga R, Kabwe G (2006) Typology and characteristics of farmers planting improved fallows in southern Africa. *Zambian Journal of Agricultural Sciences 8(2): 1-5*

7. Ajayi OC, Akinnifesi FK., Mulila-Mitti J, de Wolf J,  Matakala PW, Kwesiga F, (2006a) Adoptability, profitability, impacts and scaling up of agroforestry technologies in southern African countries. *Unpublished ICRAF publications.*

8. Alavalapati JRR, Luckert MK, Gill D (1995) Adoption of agroforestry practices: a case study from Andhra Pradesh, India. *Agroforestry systems 32(1):1-14*

9. Amacher G, Ersado L, Hyde W, Osorio A (2004)Tree planting in Tigray, Ethiopia: the importance of human disease and water microdams. *Agroforestry Systems 60(3): 211-225*

10. Amsalu A, De Graaff J (2007) Determinants of adoption and continued use of stone terraces for soil and water conservation in an Ethiopian highland watershed. *Ecological Economics 61(2-3): 294-302*

11. Andrew HR, Rikoon JS (1997) Temporal and spatial dimensions of knowledge: implications for sustainable agriculture. *Agric. Human Values 14:145–158*

12. Arnold JEM (1991) Community forestry ten years in review. Produced by forestry department, Food and Agriculture Organization, ROME

13. Arnold M, Dewees P (1998) Rethinking Approaches to Tree Management by Farmers. Natural Resource Perspectives Overseas Development Institute, London

14. Baerenklau K A, Knapp KC (2007) Dynamics of agricultural technology adoption: age, structure, reversibility and uncertainty. *American Journal of Agricultural Economics 89(1): 190–201*

15. Basamba TA, Kiiza B, Mayanja C, Nakileza B, Matsiko F, Nyende P, Kukunda EB (2012) Linking markets to small holder agroforestry farmers as a strategy for poverty alleviation in the tropics. *Journal of agricultural science and technology B2: 329-338*

16. Boeckmann SP, Iolster P (2010) Agroforestry in Africa: Exploring the Lack of Widespread Implementation and the Potential for Expansion. Available from http://www.rmportal.net/library. Accessed on 20.09.2015

17.  *Chambers R, Pacey A, Lori AT (1989). Farmer first: farmer innovation and agricultural research. Intermediate Technology Publications, London*

18.  *Chauhan SK, Nanda RK, Brar MS (2009) Adoption of poplar based agroforestry as an approach for diversified agriculture in Punjab. Indian Forester 135 (5): 671-677*

19.  *Chowdhury S, Ray P (2009) Participatory constraint analysis regarding the adoption of IPM technologies in pointed gourd cultivation: An empirical study. Journal of Bangladesh Agricultural University 7(2): 219-227*

20.  *Current D, Scherr SJ (1995) Farmer costs and benefits from agroforestry and farm forestry projects in Central America and the Caribbean: Implications for policy. Agroforestry Systems 30: 87-103*

21.  *Dearing JW (2009) Applying Diffusion of Innovation Theory to Intervention Development. Research on Social Work Practice 19(5): 503 - 518*

22.  *Dhyani SK, Sharda VN (2005) Agroforestry systems as rural development options for the Indian Himalayas. Journal of tree science 24 (1): 1-19*

23.  *Dwivedi RP, Karemulla K., Singh R, Rizvi RH, Chauhan J (2004) Socio-economic analysis of agroforestry systems in Western Uttar Pradesh. Indian Res. J. Ext. Edu. 7 (2-3): 18-22*

24.  *Feder G, Umali, DL (1993) The adoption of agricultural innovations: A review. Technological Forecasting and Social Change 43 (3-4): 215-239*

25.  *Feder G, Just RE, Zilberman D (1985) Adoption of Agricultural Innovations in Developing Countries: A Survey. Economic Development and Cultural Change 33(2): 255-298*

26.  *Fones-Sundell M, Teklehaimanot Z (2006) Mobilizing agroforestry capacity for development. Final evaluation of the African Network for Agriculture, Agroforestry and Natural Resources Education (ANAFE) and Zambia Agroforestry Project (ZAP) (Sida evaluation No. 07/03), Stockholm*

27.  *Franzel S (2004) Financial analysis of agroforestry practices: fodder shrubs in Kenya, woodlots in Tanzania, and improved fallows in Zambia. In: Valuing Agroforestry Sytstems (JRR Alavalapati and DE Mercer, Eds.), Kluwer Academic Publishers, Dordrecht, The Netherlands, pp 9-38*

28.  *Franzel S, Phiri D, Kwesiga F (2002) Assessing the adoption potential of improved fallows in eastern Zambia. In: tree on the farm: assessing the adoption potential of agroforestry practices in Africa (S. Franzel and S. J. Scherr Eds.), CAB International, Walling ford, UK*

29.  *Glendinning A, Mahapatra A, Mitchell CP (2001) Modes of communication and effectiveness of agroforestry extension in Eastern India. Human Ecology 29: 283-305*

30.  *Glover EK, Hassan BA, Glover MK (2013) Analysis of socio-economic conditions influencing adoption of agroforestry practices. International journal of agriculture and agroforestry 3 (4): 178-184*

31.  *Guillerme S, Kumar BM, Menon A, Himnnewinkel C, Maire E, Santoshkumar AV  (2011) Impacts of public policies and farmers preferences on agroforestry practices in Kerela, India. agroforestry systems 48 (2): 351-364*

32.  *IAEA (2008) Management of agroforestry systems for enhancing resource use efficiency and crop productivity, IAEA, Vienna, Austria.*

33.  *ICRAF (World Agroforestry Centre) (2007) Tackling Global Challenges through Agroforestry Annual Report for 2006. World Agroforestry Centre (ICRAF). Nairobi, Kenya*

34. *Irshad M, Ashraf M, Sher H (2011) Identifying factors affecting agroforestry systems in Swat, Pakistan. African journal of agricultural research 6 (11): 2586-2593*

35. *Kabwe G (2010) Uptake of agroforestry technologies among smallholder farmers in Zambia. PhD thesis, Lincoln University, Christchurch, New Zealand*

36. *Keil A, Zeller M, Franzel S (2005) Improved fallows in smallholder maize production in Zambia: do initial testers adopt the technology? Agroforestry systems 64: 225-236*

37. *Khan ZR, Amudavi DM, Midega CAO, Wanyarna JM, Pickett JA (2008) Farmers' perceptions of a 'push-pull' technology for control of cereal stemborers and striga weed in western Kenya. Crop Protection 27(6):976-987*

38. *Kiptot E, Franzel S (2011) Gender and agroforestry in Africa: are women participating? ICRAF Occasional Paper No. 13. World Agroforestry Centre, Nairobi, Kenya*

39. *Kiptot E, Franzel S, Hebinck P, Richards P (2006) Sharing seed and knowledge: farmer to farmer dissemination of agroforestry technologies in Western Kenya. Agroforestry Systems 68(3): 167-179*

40. *Kiptot E, Hebinck P, Franzel S, Richards P (2007) Adopters, testers or pseudo-adopters? Dynamics of the use of improved tree fallows by farmers in Western Kenya. Agroforestry Systems 94: 509-519*

41. *Kiswan J, Kumar D (2003) Future of poplar in India. accessed online from www.fao.org/forestry accessed on 02.05.2015*

42. *Kumar BM, Peter KV (2002) Woody perennials in the farmlands of Kerala–policy and legal aspects.*

43. *Lambin EF, Turner BL, Geist HJ, Agbola SB, Angelson A, Bruce JW, Coomes OT, Dirzo R, Fischer G, Folke C, George PS, Homewood K, Imbernon J, Leemans R, Li X, Moran EF, Mortimer M, Ramakrishnan PS, Richards JF, Skanes H, Steffen W, Stone GD, Svedin U, Veldkamp TA, Vogel C, Xu J (2001) The causes of land- use and land- cover change: moving beyond the myths. Glob. Environ. Change 11:261–269*

44. *Mandal BS, Mandal N, Kaushik JC, Nandal DPS (2011)  Farmers, forestry, profitability leads to crop diversification: agroforestry is one of the indispensable options for land management in future. Paper presented at IUFRO symposium on "short rotation forestry: synergies for wood production and environmental amelioration" (february 10-12, 2011), PAU Ludhiana (India).*

45. *Matata PZ, Ajayi OC, Oduol PA, Agumya A (2008) Socio-economic factors influencing adoption of improved fallow practices among smallholder farmers in western Tanzania. Int. NGO J. 3:68–73*

46. *McDonald M, Brown K (2000) Soil and water conservation projects and rural livelihood options for design and research to enhance adoption and adaptation. Land Degradation and Development 11: 343-361*

47. *Mc Ginty MM, Swisher ME, Alavalapati J (2008) Agroforestry adoption and maintenance: Self efficacy, attitudes and socio-economic factors. Agroforestry systems, 73 (2): 99-108*

48. *Mekoya A, Oosting SJ, Fernandez-Rivera S, Zijpp AJV (2008) farmers' perception about exotic multipurpose fodder trees and constraints to their adoption. Agroforestry syst. 73: 141-153*

49. *Mercer DE, Miller RP (1998) Socioeconomic research in agroforestry: progress, prospects, and priorities. Agroforestry Systems 38:177-193.*

50. *Mercer DE, Pattanayak, SK (2003) Agroforestry Adoption by Smallholders. In: Forest in a Market Economy (EO Sill and KL Abt, Eds.), Kluwer Academic Publisher, The Netherlands.*

51. *Mercer E, Snook A (2004) Analyzing ex-ente agroforestry adoption decisions with a attribute based choice experiments In:*

*valuing agroforestry systems ( JRR Alavalapati and  DE Mercer Eds.) Kluwer Academic Publishers, The Netherlands,  pp 237-256*

52. *Mombo LF, Senkondo M,  Makonda F (2016) Attitude, adoption and economic potential of agroforestry in Kilosa District, Tanzania. International journal of agriculture innovations and research 4 (5): 883-893*

53. *Msuya TS, Kideghesho JR (2012)* **Mainstreaming Agroforestry Policy in Tanzania Legal Framework.** *In: Agroforestry for Biodiversity and Ecosystem Services – Science and Practice (Martin Leckson Kaonga Eds.) Published by Intech publishers. Available at www.intechopen.com. accessed on 03. 06. 2016.*

54. *Mudhara M, Hildebrand P (2004) Assessment of constraint to the adoption of agroforestry of improved fallows in Zimbabwe using linear programming models, In: Valuing Agroforestry Systems (JRR Alavalapati and DE Mercer, Eds.) Kluwer Academic Publisher, The Netherlands, Pp. 201–218*

55. *Muhammad S, Garforth C (1999) Farmers' Information sources and their relative effectiveness. International Journal of Agriculture and Biology 1(4): 222-226*

56. *Mutambara J, Duve IV, Muvmi BM (2012) Agroforestry technologies involving fodder production and implication on livelihood of smallholder livestock farmers in Zimbabwe. A case study of Goromonji District. Live stock research for rural development. Accessed online from www.irrd.org//irrd/24/11/muta2421 accessed on 10.09.2016*

57. *Negatu W, Parikh A (1999). The impact of perception and other factors on the adoption of agricultural technology in the Moret and Jiru Woreda (district) of Ethiopia. Agricultural Economics 21(2): 205-216*

58. *Nguyen TQ (2001) Farmers' Training and the Adoption of Upland Agricultural Technologies in the Black River (Song Da) Watershed, Northeast of Vietnam. Paper presented at the Conference on International Agricultural Research for Development. 9-11 October 2001, Bonn*

59. *Nkonya E, Schroeder T, Norman D (1997) Factors affecting adoption of improved maize seed and fertiliser in northern Tanzania. Journal of Agricultural Economics 48(1): 1-12*

60. *Nowak P (1992) Why framers adopt production technology. Journal of Soil and Water Conservation 47(1): 14-16*

61. *Okia CA, Agea JG, Sekatuba J, Ongodia G, Katumba B, Opolot VI, Mutabazi H(2009) Candidate agroforestry technologies and practices for Uganda. Agric. J. 4: 208-215*

62. *Opio C (2001) Biological and Social Feasibility of Sesbania fallow practice in Small Holder Agricultural Farms in Developing Countries: A Zambian Case study. Environmental Management 27(1): 59-74*

63. *Oudwater N, Martin A (2003) Methods and issues in exploring local knowledge of soil. Geoderma 111: 387-401*

64. *Pandey DN (2005) Multi functional agroforestry systems in India for Livlihoods: current knowledge and future challenges. Centre for international forestry research, Indonesia /Jaipur, Rajasthan, India.*

65. *Peterson JS, Tembo L, Kawimbe C, Mwangamba E (1999) The Zambia Integrated Agroforestry Project baseline survey: lessons learned in Chadiza, Chipata, Katete and Mambwe Districts, Eastern province, Zambia.World Vision International, Univesity of Florida and Ministry of Agriculture, Chipata, Zambia*

66. *Phiri D, Franzel S, Mafongoya PL, Jere I, Katanga R, Phiri S (2004) Who is using the new technology? the association of wealth status and gender with the planting of improved tree fallows in Eastern Province, Zambia. Agricultural Systems 79 (2): 131-144*

67. *Place F, Dewees P (1999) Policies and incentives for the adoption of improved fallows. Agroforestry Systems, 47: 323-343*

68. *Place F, Ajayi OC, Torquebiau E, Detlefsen G, Gauthier M, Buttoud G (2012) Improved policies for facilitating the adoption of agroforestry. In: Agroforestry for biodiversity and ecosystem services-Science and Practices ( M.L.Kaonga Eds.), pp. 113-128*

69. *Puri, S, Nair, PKR (2004) Agroforestry research for development in India: 25 years of experiences of a national program. Agroforestry systems 61: 437-452*

70. *Rahman SA, De Groot WT, Snelder DJ (2008) Exploring the agroforestry adoption gap: financial and socioeconomics of agroforestry by small holders in Bangladesh. In: CIFOR strategy: stepping up to the new climate and development agenda 2016-2025. www.cifor.org accessed on 15.3.2016.*

71. *Rai A, Srivastava AK, Singh M (2006) A socio-economic study on agroforestry in Chhachhrauli Block of Yamuna Nagar District of Haryana. Indian journal of Agroforestry 3 (2):148-152*

72. *Rajasekharan P, Veeraputhran S (2002) Adoption of intercropping in rubber smallholdings in Kerala, India: a probit analysis. Agroforestry Systems 56(1): 1-11*

73. *Rogers EM (2003) Diffusion of Innovations (5th Ed.), Free Press, New York*

74. *Safa MS (2005) Socio-economic factors affecting the income of small scale agroforestry farms in Hill Country areas in Yemen: A comparision of OLS and WLS determinant. Small scale forest economics, management and policy 4 (1): 117-134*

75. *Sail R M, Muhammad M (1994) Factors Associated with Non-adoption of Technology by Rubber Smallholders. Pertanika Journal Social Science and Humanities 2(1), 29-41*

76. *Samiee A, Rezvanfa A, Faham E. (2009) Factors influencing the adoption of integrated pest management (IPM) by wheat growers in Varamin County, Iran. African Journal of Agricultural Research 4(5): 491-497*

77. *Scherr, S. 1995. Economic factors in farmer adoption of agroforestry: pattern observed in Western Kenya. World Dev 23 (5):787–804.*

78. *Sechrest L, Stewart M, Stickle T (1998) Factors affecting the adoption and impact of CGIAR innovations: A synthesis of findings (A report submitted to the Impact Assessment and Evaluation Group (IAEG)), University of Arizona.*

79. *Sharma SK, Chauhan S, Sharma SK, Kaur B, Arya ID (2009) opportunities and major constraints in agroforestry systems of Western U.P.: A vital role of star paper mills, Saharan Pur (UP)- India. agriculture and biology journal of north America 1 (3): 343-349*

80. *Sharma VP, Kumar A (2000) Factors influencing adoption of agroforestry programme: A case study from North- West India. Indian journal of agriculture economics 55 (3): 500-510*

81. *Shiferaw BA, Okello EJ, Reddy RV (2009) Adoption and adaptation of natural resource management innovations in smallholder agriculture: reflections on key lessons and best practices. Environmental Development Sustainability 11: 601-619*

82. *Singh VK, Pandey DN (2011) Multi functional agroforestry systems in India: Science based policy options. Compendium of papers, First Indian forest congress, ICFRE (November 22- 25). 2: 126-140*

83. *Smith J, Doring T, Pearce BD, Wolfe MS (2012) Developing modern multifunctional agroforestry systems for sustainable intensification. In: Agriculture and the environment XI, Valuing ecosystems: policy, Economic and Management interactions. Pp. 257-262*

84. *Sood KK (2006) The influence of household economics and farming aspects on adoption to traditional agroforestry in Western Himalaya. Mountain Research and Development 26 (2):124-130*

85. *Sood KK, Mitchell CP (2009) Identifying important biophysical and social determinants of on-farm tree growing in subsistence-based traditional agroforestry systems. Agroforestry Systems 75:175–187*

86. *Surendra, P Mahesha M (2015) Impact of socio-economic factors on use of information sources- a study of paddy farmers in Mandya district of Karnataka. Quest International Multidisciplinary Research Journal, 4(4): 186-190, Available Online at* [http://www.researchjournals.in](http://www.researchjournals.in)*. accessed on 20.06.2016*

87. *Tenge AJ, Graaff JD, Hella JP (2004) Social and economic factors affecting the adoption of soil and water conservation in West Usambara highlands, Tanzania. Land Degradation & Development 15(2): 99-114*

88. *Thangata PH, Alavalpati JRR (2003) Agroforestry adoption in Southern Malawi: the case of mixed intercropping of Gliricidia sepium and Maize. Agricultural systems 78: 57-71*

89. *Thangata PH, Alavalapati JRR, Hildebrand PE (2004) Meta modeling agroforestry adoption In: Valuing Agroforestry Systems ( J. R. R. Alavalapati and D. E. Mercer, Eds.) Kluwer Academic Publishers. Printed in the Netherlands. Pp. 219-236*

90. *Vail DJ (1981) Women and Small Farm Revival: The Division of Labor and Decision-Making on Maine's Organic Farms. Review of Radical Political Economics 13(4):19-32*

91. *Zubair M, Garforth C (2006) Farm level tree planting in Pakistan: The role of farmers˝ perceptions and attitudes. Agroforestry Systems 66: 217-229*